September 15, 2015

Via Electronic Filing

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

Re: **Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band; GN Docket No. 14-177 and RM-11664**

Dear Ms. Dortch:

EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, and Alta Wireless, Inc. (collectively, "EchoStar") hereby submit this *ex parte* letter in support of the recent letter from the Satellite Industry Association ("SIA") urging the Commission not to rush to take action in this proceeding before the upcoming World Radiocommunication Conference 2015 ("WRC-15") in November.[1] At the WRC-2015, administrations will consider a number of topics to recommend for further study and may make decisions on allocation matters, both of which may relate to this proceeding. Thus, waiting until after the WRC-15 would allow interested parties, including the Commission, to take into consideration those WRC-15 determinations. Additionally, as noted by SIA, the *Spectrum Frontiers NOI*[2] raises complex technical and policy matters that require careful thought and deliberation, and further input on a number of matters from a range of parties, including current licensees, prospective 5G operators, equipment manufacturers and standards organizations, is necessary for an informed Commission decision.

---

[1] *See* Letter to Marlene Dortch, Secretary, Federal Communications Commission, from Tom Stroup, President, Satellite Industry Association, GN Docket No. 14-177 and RM-11664 (Aug. 28, 2015).

[2] *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services; Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.00 GHz Bands; Implementation of Section 309(j) of the Communications Act—Competitive Bidding, 37.0-38.6 GHz and 38.6-40.0 GHz Bands; Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band*, Notice of Inquiry, 29 FCC Rcd 13020 (2014) ("*Spectrum Frontiers NOI*").

Specifically, as identified below, EchoStar believes that there are many critical questions and issues that the Commission has not yet addressed in this proceeding. EchoStar urges the Commission to take steps that would address these and other matters to ensure the development of a more fulsome record in this proceeding prior to the release of any Notice of Proposed Rulemaking.

1) More recent research by Dr. Gerhard Fettweis, one of the authors that participated in the IEEE "5G Wireless Communications Systems: Prospects and Challenges," cited in the *Spectrum Frontiers NOI*,[3] suggests that antenna arrays for the 30 - 60 GHz range would not be cost effective because they are too large to integrate on a chipset. In contrast, antenna arrays in the 120 GHz and 240 GHz range would be much more cost effective and could deliver better performance and range.[4] Given Dr. Fettweis' more recent conclusions, should the scope of the *Spectrum Frontiers NOI* proceeding include frequencies above 95 GHz?

2) Likewise, Dr. Fettweis' more recent research raises important questions regarding the Commission's implicit assumption, based on conclusions drawn from a now-dated Technical Advisory Committee ("TAC") presentation from 2013, that the Commission should focus on frequencies below 95 GHz for 5G.[5] Has the TAC recently updated any of its analyses regarding frequencies below 95 GHz or above 95 GHz?

3) Given that 5G may ultimately include bands above 95 GHz, in addition to those between 24 GHz and 95 GHz, and that new air interfaces will be necessary to meet the requirements of 5G, what potential is there for interoperability across the various 5G bands? Technology standards that are comprehensive, integrated, and interoperable across all bands, including bands above 95 GHz, would reduce complexity and increase flexibility to develop 5G applications that operate across multiple bands.

4) Ultra-low latency is a critical part of 5G, especially for tactile internet applications for which one millisecond or less is a requirement. As Dr. Fettweis

---

[3] Dr. Fettweis's presentation (5G requirements and frequencies: avoiding the valley of death (May 2015)) may be viewed at the following link: http://johannesbergsummit.com/video-with-gerhard-p-fettweis/.

[4] *See also* 4G Americas, "5G Spectrum Recommendations" at 16-17 (Aug. 2015), http://www.4gamericas.org/files/6514/3930/9262/4G_Americas_5G_Spectrum_Recommendations_White_Paper.pdf (acknowledging that "[i]n mm-wave bands, highly integrated Radio Frequency Integrated Circuit (RFIC) solutions providing complete transmitter and receiver chains are clearly desirable to meet the size, cost and power consumption needs of future generations of mm-wave radio products.").

[5] *See Spectrum Frontiers NOI* ¶ 50 n. 64. Dr. Fettweis' comments in this regard appear at 23:20 in the video. *See supra* note 3

explained in his presentation, an advantage of frequencies above 95 GHz is that small size antenna arrays can be directly implemented on 3D stacked chipsets, which eliminates the losses and delays due to feeder lines and improves performance. Which frequency ranges would be better suited to achieve the 5G requirement for end-to-end latency of less than one millisecond?

5) Without additional technical data regarding current incumbent operations, any proposed technical sharing rules would essentially be meaningless.[6] Before the Commission could establish sharing criteria, it would need answers, which are largely missing from the record, to the following types of questions:

   - What are typical transmit power levels and antenna patterns for earth stations operating in the Ka-band frequencies?

   - What technical and regulatory requirements would ensure that Fixed-Satellite Service ("FSS") operators and Local Multipoint Distribution Service ("LMDS") operators could operate on a co-primary basis in the same band?

   - What would be the impact on satellite earth stations from 5G systems? What would a possible sharing environment look like? What size exclusion zones are necessary to protect earth stations?

6) Similarly, with respect to terrestrial operations, the Commission would need to obtain data to better understand potential cumulative interference from 5G systems to other operations, including answers to the following types of questions:

   - What compatibility models or studies have been created or conducted to analyze the potential cumulative interference of 5G systems (*e.g.*, from all base stations or all mobile stations in a particular frequency band) to incumbent systems? What technical assumptions were made for those models or studies?

   - Have such models or studies been created or conducted in those cases where 5G spectrum could be assigned for multiple systems (*e.g.*, International Mobile Telecommunications and High-Altitude Platform Stations)? In general, how would the cumulative interference from multiple systems be analyzed?

---

[6] *See, e.g.*, Intel Corporation, "Recommendations on the Use of Spectrum Bands Above 24 GHz for Mobile Radio Services" at 7 (Aug. 5, 2015) (FCC must seek input from incumbent operators to establish protection criteria), attached as an exhibit to Letter to Marlene Dortch, Secretary, FCC, from Dave Horne, Global Public Policy Group, Intel Corporation, GN Docket No. 14-177 (Aug. 10, 2015).

7) There are no developed propagation models for 5G systems above 24 GHz, and current empirical propagation models used for 3G and 4G are valid only for frequencies up to approximately 3 GHz.[7] Accordingly, the Commission effectively would have to use a conservative Free Space Loss model to assess propagation for interference purposes. Is the Commission considering using other propagation models? If so, what propagation models would be used for calculating interference from 5G systems into incumbent systems? If the Commission has developed such models, when would they be made available for review? How would such models address building penetration loss? For a propagation model to calculate the interference into satellite systems, how would the reflection and absorption of buildings and terrain be taken into account in addition to free-space loss towards the satellite? Will the propagation models be tested and supported by measurements?

8) 3GPP and other standard organizations are currently developing the technical transmit and receive parameters (*e.g.*, transmit power, spectrum emission mask, and required Signal to Interference and Noise Ratio) and deployment parameters (*e.g.*, typical cell size, cell layout, and antenna heights) for 5G systems. Technical specifications likely will be finalized by 2020. At the same time, the International Telecommunication Union likely will be conducting studies regarding potential use of the frequency bands above 24 GHz for International Mobile Telecommunication systems, and regulators internationally will be reviewing spectrum allocations for such bands. Given that such assessments have not been completed yet and the Commission has not conducted its own technical analyses, how does the Commission intend to propose technical and deployment parameters for 5G services? Does the Commission intend to propose technical parameters that will be the same for all frequency bands above 24 GHz or will the parameters be band specific?

9) In the *Spectrum Frontiers NOI,* the FCC discussed several licensing models, including exclusive licenses, shared licenses, and unlicensed use. For each type of potential licensing regime, how would the current and future operations of incumbent operators be protected? If the FCC were to adopt a new terrestrial licensing model in the FSS bands, how would current and future FSS operation be licensed? Are there public interest benefits to giving FSS earth station operators exclusivity in certain frequency bands? In the lower LMDS band, are there public interest benefits to elevating FSS operations to co-primary status? Would incumbent licensees be able to expand their licenses to include mobile operations?

---

[7] For example, the commonly used empirical propagation model, COST231, is valid up to 2 GHz, but it is often extrapolated and used for frequencies up to about 3 GHz. However, extrapolation of this model to frequencies considered for 5G would not be valid.

In sum, EchoStar supports SIA's logical recommendation that the Commission take action in this proceeding only after careful and deliberate consideration of the complex technical and policy matters raised in this proceeding, including the issues identified above and developments at the WRC-15.

Please let us know if you have any questions or require additional information.

Very Truly Yours,

/s/Jennifer A. Manner

Jennifer A. Manner
Vice President, Regulatory Affairs
EchoStar Satellite Operating Corporation
301-428-5893
jennifer.manner@echostar.com

cc: Jose Albuquerque
Jessica Almond
Brendan Carr
Diane Cornell
Mindel De La Torre
Michael Ha
Chris Helzer
Julius Knapp
John Leibovitz
Tim Maguire
Erin McGrath
Louis Peraertz
Johanna Thomas